Silicon Mountain Design

30 March 1995

Office of Naval Research
Attn: William Miceli, ONR 313, Program Officer
Ballston Tower One
800 North Quincy Street
Arlington, VA 22217-5660

Reference: Contract N00014-94-C-0241
"An Ultra-High Speed Incoherent-to-Coherent Converter for Optical Computing"

In accordance with contract data requirements, enclosed is the monthly status report for the period 1 March - 31 March 1995.

If you have any comments or questions you may contact me at (719) 576-4800.

Sincerely,

David W. Gardner
Program Manager

Encl.

Copy to: DCMAO Denver
Director, Naval Research Laboratory, Code 2627
Defense Technical Information Center (2)
Ballistic Missile Defense Organization - T/IS

Letter only to: DCMO COS

2864 SOUTH CIRCLE DRIVE, SUITE 900
COLORADO SPRINGS, COLORADO 80906
OFFICE (719) 576-4800 FAX (719) 576-4170

Office of Naval Research
Arlington, VA
Contract N00014-94-C-0241

Monthly Status Report
March 1 - March 31, 1995

DESCRIPTION

Many optical computing problems are centered around the processing of incoherent images. These images may be conventional visible light such as those taken with a CCD imager or camcorder. They may also take the form of infrared images in the case of missile seekers or x-ray images from medical or other sources. For optical processing, these images must be converted to either phase or amplitude modulated coherent light. This is typically accomplished by electronically feeding the originally captured image into a spatial light modulator (e.g., liquid crystal or deformable mirror array) and modulating a coherent reference beam with the 2 dimensional data pattern. The electrical input to the SLM creates a data flow bottleneck in the optical processing system due to the inherently serial input architecture. SMD has proposed a novel incoherent to coherent image converter which solves this problem by providing a massively parallel, optical input feed capability. The proposed architecture utilizes a novel combination of micromachining and ultra-thinned wafer technology to achieve an integrated incoherent to coherent image converter. The converter is capable of directly converting UV, IR, visible, and x-ray energy to a coherent light representation allowing for maximum utilization of downstream optical processing.

MARCH ACTIVITIES

During March, fabrication and basic test of the incoherent-to-coherent converter array was completed. Functionality of the transistors which comprise the multiplexer was verified (see attachment #1). These transistors exhibited a switching voltage of approximately 4 volts and were quite well behaved. Photo response of the silicon photodiodes was tested using a semiconductor probe station illuminator light (see attachment #2). Reverse bias conduction current indicates the photosites response to low level illumination. The difference between light and dark level conduction currents becomes more evident as the reverse bias condition is increased (the larger depletion under reverse bias increases the effective photon cross section). Mechanical deflection of the micromechanical grating structures has been verified and deflection rates of over 1 million frames per second has been measured.

TO GO ACTIVITIES

A one month, no-cost extension has been requested to allow for additional testing of the incoherent to coherent converter array (see attachment #3). During the month of April, device characterization will be completed and documented.

A final report will be prepared and submitted documenting the work done on this program.. In addition, a Phase II development proposal will be submitted detailing the work necessary to build

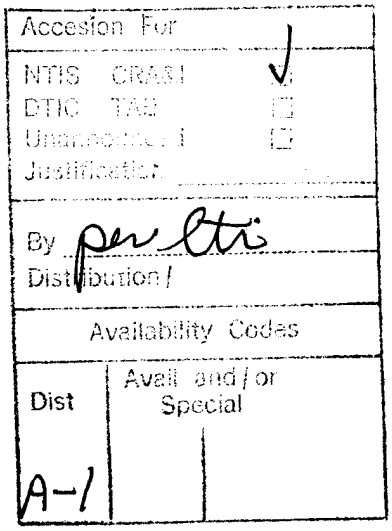
and demonstrate a full converter array. Commercial commitments are currently being pursued for the Phase III effort.

PROBLEMS/CONCERNS

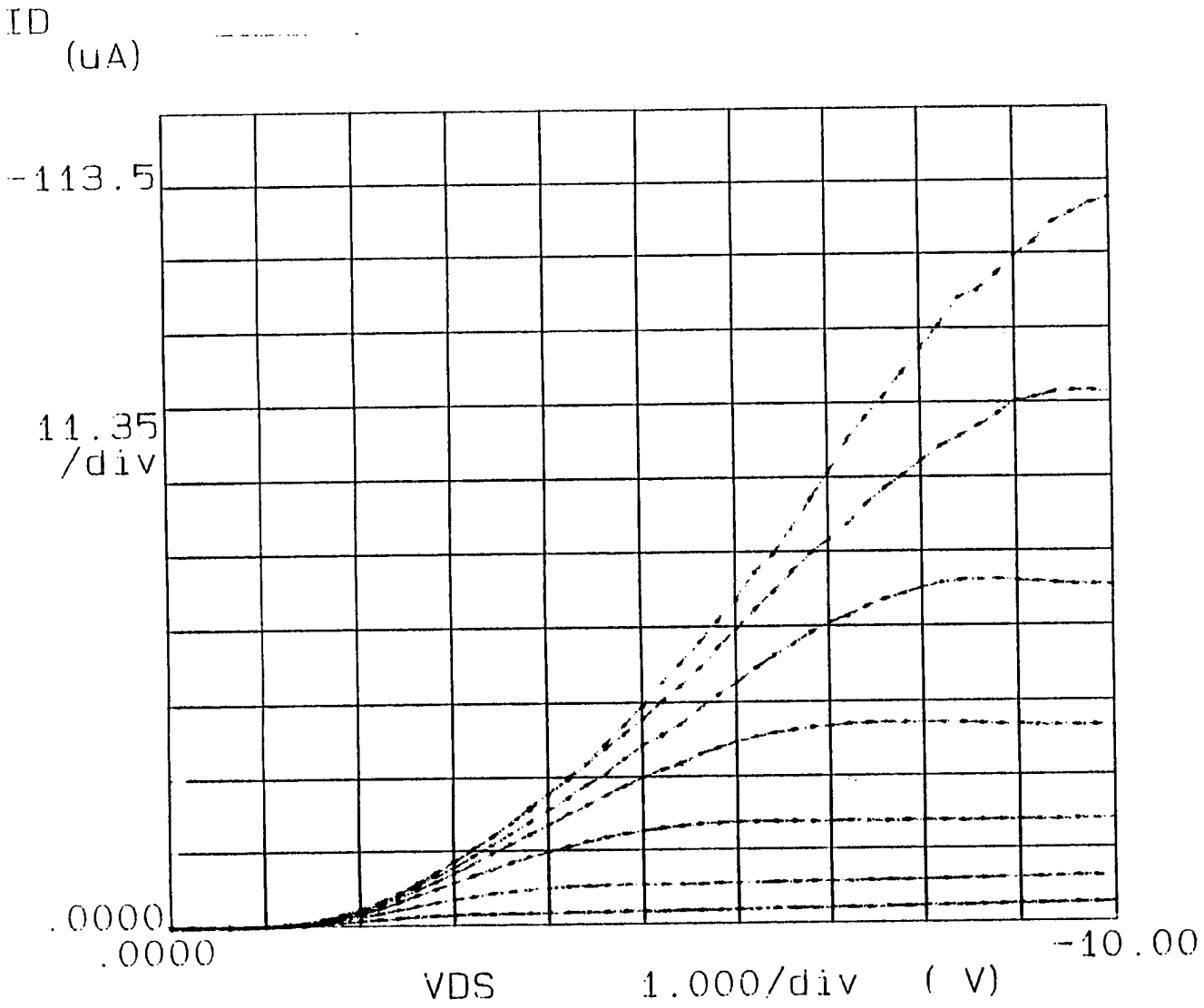
None

SCHEDULE/BUDGET

Due to delays in device fabrication, the program schedule is delayed by one month. The program is within budget.



****** GRAPHICS PLOT ******



Variable1:
VDS -Ch2
Linear sweep
Start .0000V
Stop -10.000V
Step - .2000V

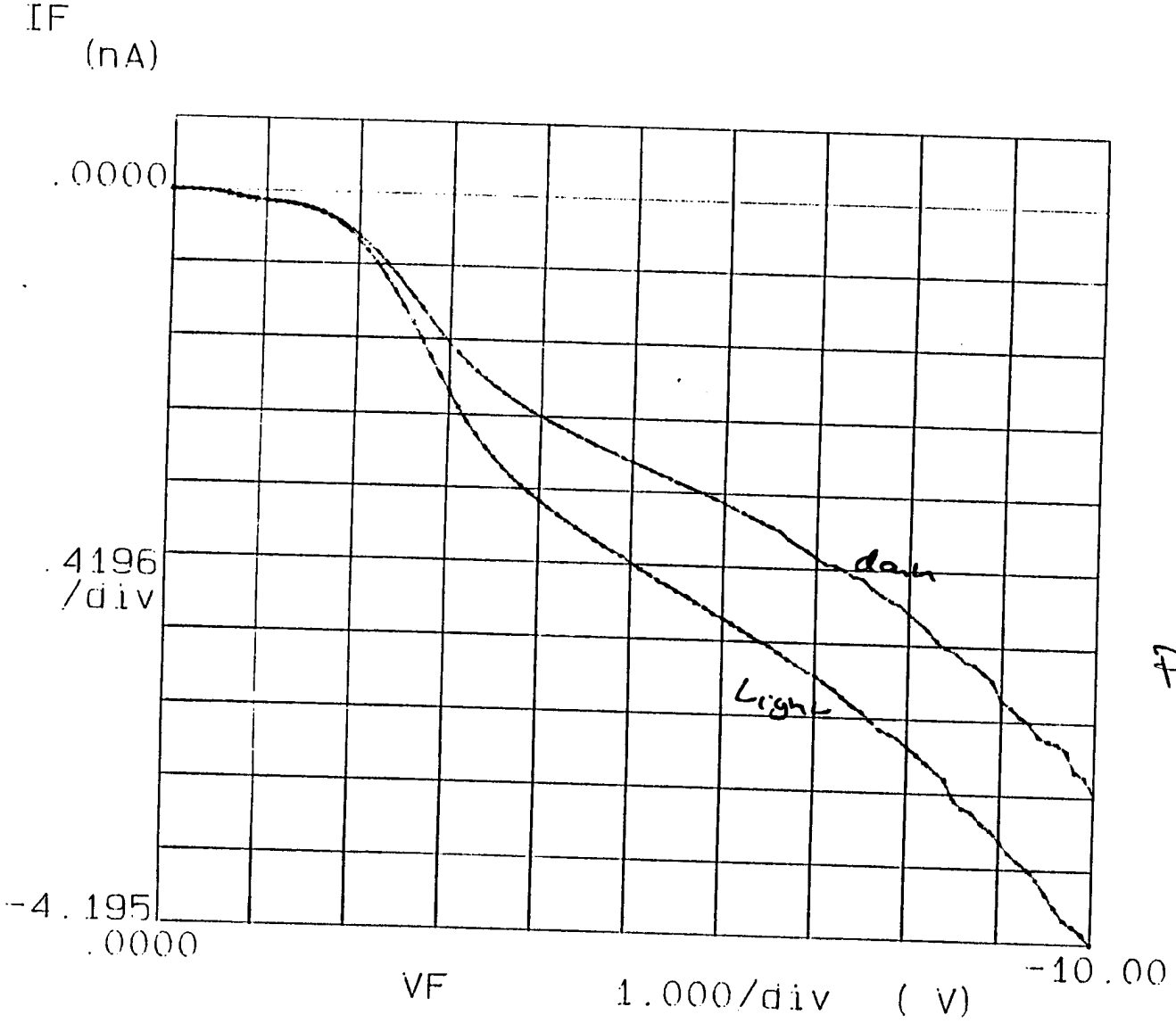
Variable2:
VG -Ch3
Start -5.0000V
Stop -8.0000V
Step - .5000V

Constants:
VS -Ch1 .0000V

MOS I-V

Multiplexer Transistor response

****** GRAPHICS PLOT ******



Variable1:
VF -Ch1
Linear sweep
Start .0000V
Stop -10.000V
Step - .1000V

Constants:
V -Ch3 .0000V

Reverse bias diode

Photodiode optical response

Increasing depletion region width